INSHORE SEA TEMPERATURES AT KAIKOURA, NEW ZEALAND, 1973-1975

J.R. OTTAWAY

Department of Zoology, University of Canterbury,
Christchurch, New Zealand

ABSTRACT

Inshore sea temperature records are presented for four stations on the coast south of Kaikoura, New Zealand (173° 42' E, 42° 25' S). Readings were taken between 18 January 1973 and 8 March 1975. The annual mean temperature range was 8.5°C to 19°C, and the cold-temperate mixed waters of the Kaikoura region (Knox 1960, 1963) have an annual mean fluctuation typical of New Zealand waters (Oliver 1923).

INTRODUCTION

There are few published records of inshore sea temperatures at Kaikoura, despite a number of ecological studies on inshore and intertidal organisms carried out there. From January 1973 to March 1975 I measured sea temperatures, at weekly intervals, at four sites on the Kaikoura coast, and a summary of the measurements is presented in this paper.

METHODS

All temperatures were measured with a mercury-in-glass thermometer, calibrated to 0.1°C. Temperatures were taken at a depth of 0.5 m of water, in a total depth of about 1 m. Morning temperatures were taken at dawn (± 45 min.), weekly between 18 January 1973 and 8 March 1975, and afternoon temperatures were taken weekly at 1400 h (± 45 min.) (New Zealand Standard Time), between 18 August 1974 and 8 March 1975. The former readings were taken to indicate approximate minimum temperatures for the day, and the latter readings approximate maximum temperatures for the day.

The four stations at Kaikoura (Figure 1) were:

1. The reef outside the Edward Percival Marine Laboratory (173° 42' E, 42° 25' S).
2. The inshore edge of Baxter's Reef, South Bay.
3. The southern entrance to the Parititahi road tunnel.
4. The northern entrance to the Raramai road tunnel.

Stations 1 (S1) and 2 (S2) were in sheltered bays of the Kaikoura Peninsula, while Stations 3 (S3) and 4 (S4) were on the open coast about 10.5 km WSW of the township of Kaikoura. Temperatures were always taken in the sequence: S1, S2, S3, and S4, and there was never more than 55 min. delay between readings at S1 and S4.

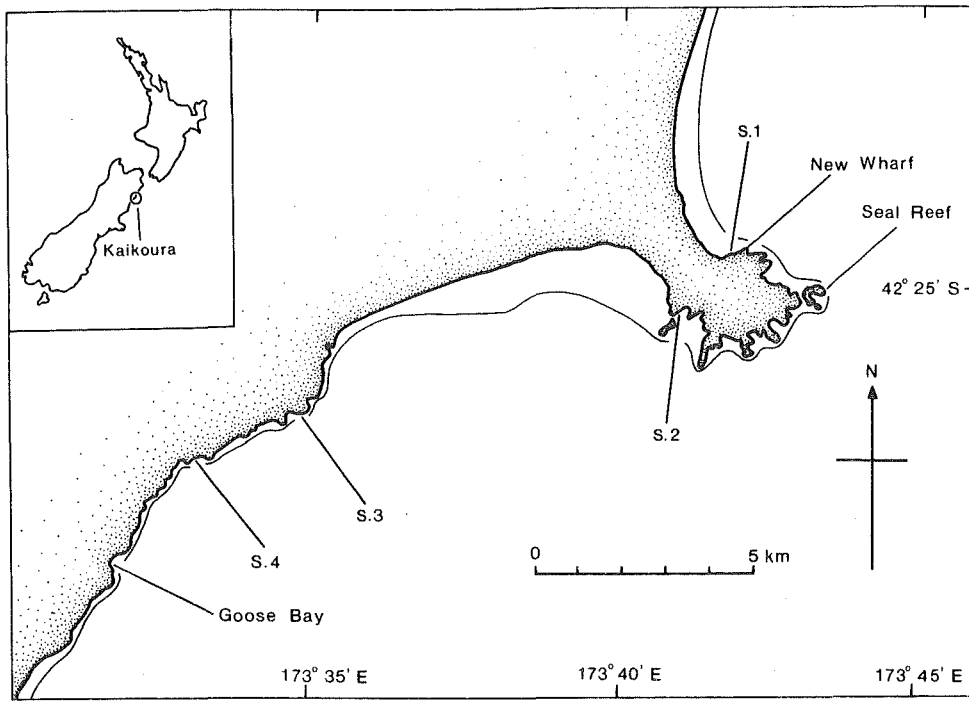

Fig. 1 Map of the Kaikoura area showing stations and localities described in text. S1: reef by Edward Percival Marine Laboratory; S2: inshore edge of Baxter's Reef; S3: south entrance to Parititahi road tunnel; S4: north entrance to Raramai road tunnel. Offshore line shows approximate position of 10 m depth contour.

Curves for mean sea temperatures were fitted by eye (Figures 2a, 2b).

RESULTS

Actual temperature values recorded at S1 and S3 are shown in Figure 2, while the absolute minimum and maximum readings of inshore sea temperatures, for each station for each month, are given in Tables 1 and 2.

From the fitted curves of mean sea temperatures, the annual ranges at the four stations were: S1, 8-20°C; S2, 8-19.5°C; S3, 9-18°C; S4, 9-18°C. Minimum mean temperatures occurred at dawn in late July, and maximum mean temperatures occurred at 1400 h in late January. Mean daily fluctuations were greatest in summer, and were almost 3°C for S1 and S2, but only 1°C for S3 and S4. Greatest mean sea temperature fluctuations, both daily and mean annual, occurred on the reef outside EPML (S1), and it was here too that the absolute extremes were measured. The absolute minimum temperature recorded was 6.8°C (0615 h, 23 August 1973) and the absolute maximum was 22.6°C (1345 h, 4 December 1974).

TABLE 1. ABSOLUTE MINIMUM AND ABSOLUTE MAXIMUM READINGS OF DAWN INSHORE SEA TEMPERATURES DURING THE PERIOD 18 JANUARY 1973 - 8 MARCH 1975. n = Number of readings for month.

Month	n	Station 1		Station 2		Station 3		Station 4	
		min	max	min	max	min	max	min	max
1973									
January	2	16.5	17.1	17.2	17.6	15.5	15.5	15.8	16.4
February	3	15.4	16.8	14.7	16.4	15.3	16.9	15.3	17.0
March	4	14.4	16.1	14.1	16.3	14.6	16.4	14.6	16.4
April	4	12.5	13.7	12.2	13.9	12.7	14.5	12.3	14.1
May	5	9.8	12.9	10.3	13.4	11.3	13.5	10.8	13.3
June	4	8.1	9.9	7.8	9.8	9.5	10.8	9.0	10.6
July	4	7.2	8.9	7.5	9.2	9.0	9.5	8.4	9.4
August	4	6.8	9.7	7.5	9.5	8.4	9.4	8.1	9.4
September	4	9.4	11.0	9.3	10.8	9.2	10.5	9.3	10.9
October	4	9.2	12.4	9.8	11.4	10.3	12.0	10.4	11.8
November	5	12.9	14.4	13.5	14.0	13.2	14.3	12.6	14.8
December	4	13.1	15.0	12.8	15.3	12.5	15.1	12.4	15.3
1974									
January	5	14.2	17.6	14.5	17.1	15.1	16.9	14.8	16.7
February	4	14.3	18.4	13.8	18.1	14.0	17.8	14.6	17.8
March	3	11.4	15.4	12.8	15.5	13.8	15.2	13.5	15.3
April	4	12.2	14.9	12.0	14.8	13.8	14.5	13.1	14.6
May	5	8.9	11.5	9.6	11.1	11.0	12.6	10.5	12.0
June	4	8.1	9.6	8.8	9.5	9.5	11.0	9.4	10.5
July	4	8.4	8.6	8.4	8.7	9.0	9.6	8.5	9.5
August	5	8.3	9.4	7.3	9.0	8.4	9.2	8.5	9.1
September	4	9.4	11.1	8.5	11.1	9.4	11.1	9.0	11.1
October	4	9.8	12.1	10.0	12.1	10.4	12.0	10.2	12.1
November	5	10.9	15.0	10.7	14.5	11.2	14.2	11.0	14.3
December	4	15.5	17.3	13.7	17.4	13.5	16.8	14.6	16.9
1975									
January	5	13.9	17.6	16.1	18.0	16.6	18.3	16.8	18.1
February	2	15.4	17.6	15.6	17.2	16.2	16.8	16.1	16.9
March	1	15.8	15.8	15.4	15.4	15.9	15.9	15.7	15.7

TABLE 2. ABSOLUTE MINIMUM AND ABSOLUTE MAXIMUM READINGS OF 1400 h INSHORE SEA TEMPERATURES DURING THE PERIOD 18 JULY 1974 - 8 MARCH 1975. n = Number of readings for month.

Month	n	Station 1		Station 2		Station 3		Station 4	
		min	max	min	max	min	max	min	max
1974									
July	2	9.7	9.8	9.8	10.0	9.2	9.6	9.2	9.3
August	5	9.6	10.5	9.5	11.1	8.8	9.5	8.9	9.4
September	4	10.9	11.6	10.2	11.6	9.5	11.3	9.7	11.4
October	4	11.4	15.8	11.4	14.6	11.1	13.6	11.1	13.6
November	5	14.5	17.3	13.1	19.9	12.5	15.5	12.7	15.7
December	4	17.6	22.6	17.2	20.1	14.6	17.9	15.1	18.0
1975									
January	5	16.7	22.1	18.2	22.2	17.4	19.0	18.1	19.0
February	2	18.4	20.3	17.4	19.9	17.3	18.0	17.5	18.3
March	1	19.0	19.0	18.8	18.8	16.8	16.8	17.1	17.1

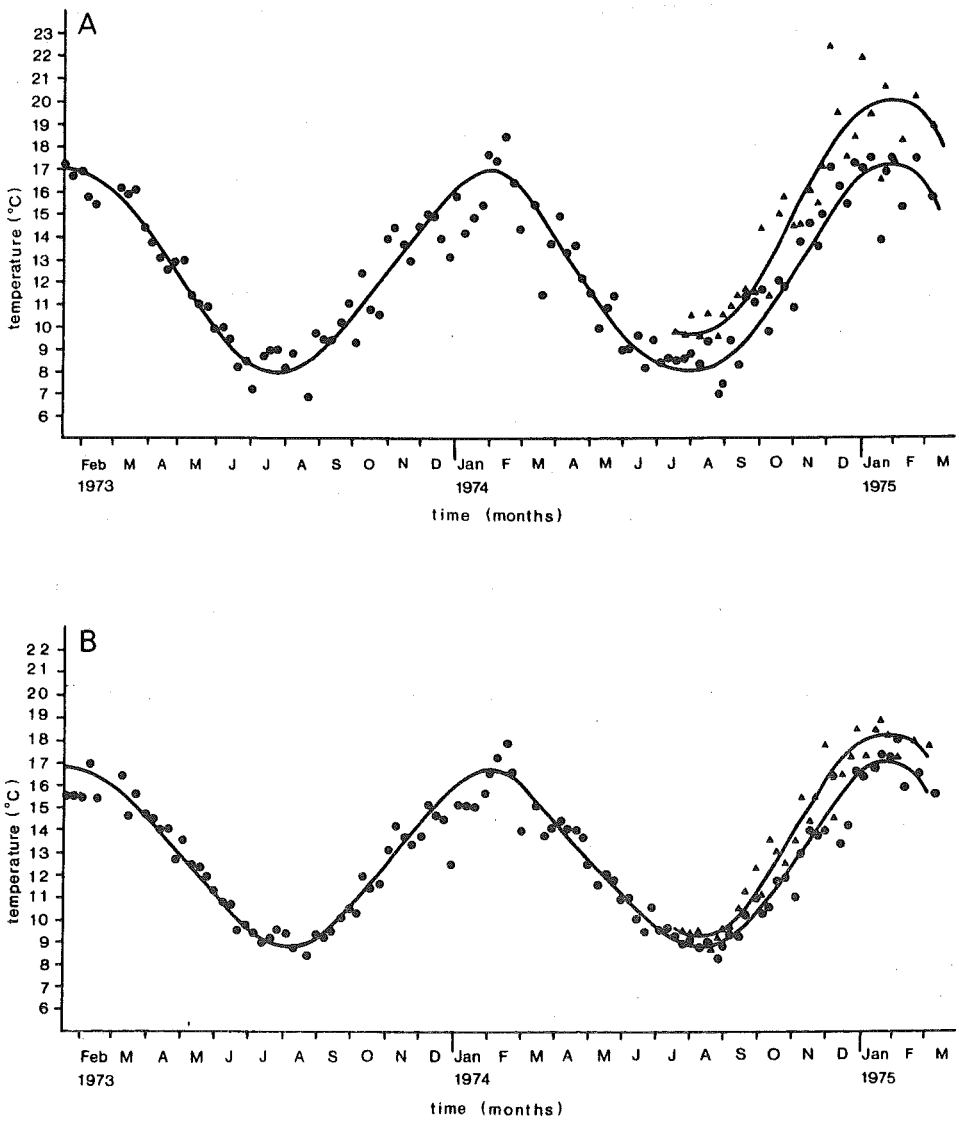

Fig. 2 Actual readings and mean curves (fitted by eye) for stations 1 (Fig. 2A) and 3 (Fig. 2B). Circle = dawn sea temperature ; triangle = 1400 h sea temperature .

DISCUSSION

McGregor (1965) measured temperature fluctuations in intertidal rock pools at Goose Bay, over a period of 24 h in October 1961, and found that the maximum fluctuation was about 3°C. Pool temperatures were about 15°C while sea temperatures were about 11.5°C. These appear to be the only records for intertidal water temperatures in the Kaikoura region, although Dix

(1970) and Poore (1973) gave temperatures for deeper inshore waters. Neither of these authors mentioned specific depths, but their readings were probably made near the sea floor at depths of about 3-5 m. Dix (1970) took single monthly readings off Seal Reef, from March 1967 to November 1968, and found that temperatures ranged from 8.5°C (July) to 16.5°C (February). Poore (1973) analysed continuous records taken at the New Wharf from July 1967 to July 1968, and found that mean monthly noon temperatures ranged from 8.5°C (July) to 16.5°C (March). These annual fluctuations are similar to that of 7°C given by Heath (1970) for Kaikoura, and are typical of New Zealand waters.

From my weekly temperature measurements taken during 1973-1975, the annual mean temperature range of shallow inshore waters at Kaikoura was found to be about 8.5°C - 19°C. This winter mean is similar to that found for deeper inshore waters (Dix 1970, Poore 1973), while the summer mean is several degrees warmer than that of deeper waters.

The two stations on the Kaikoura Peninsula (S1 and S2) had greater daily temperature fluctuations and greater mean annual temperature fluctuations than either of the stations on the open coast (S3 and S4). This probably relates to the nature of the offshore water mass. S1 and S2 are both on the edge of relatively shallow bays, which are mainly less than 10 m depth for at least 1 km from shore, whereas the sea bottom rapidly drops away from S3 and S4 to depths considerably in excess of 10 m (Figure 1).

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